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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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David James Wilson

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10/12/2006

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EXAMINER

LIE, ANGELA M

ART UNIT

PAPER NUMBER

2163

DATE MAILED: 10/12/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/731,125

Applicant(s)

WILSON, DAVID JAMES

Examiner

Angela M. Lie

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 04 August 2006.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-30 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-30 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 10 December 2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Claim Rejections - 35 USC § 101

1. 35 U.S.C. 101 reads as follows:

Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

2. Claim 1 is rejected under 35 U.S.C. 101 because the claimed invention lacks patentable utility. According to step (e) the longest matching prefix is stored if found. However the question arises when the matching prefix is not found, what is an alternative outcome? Since this alternative is not presented, the claim is considered as not having a useful result.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. Claims 1-30 are rejected under 35 U.S.C. 103(a) as being unpatentable over Turner et al (US Patent 6018524) in the view of Lin et al (US Patent 6813620).

As to claims 1,13 and 19, Turner teaches a method and apparatus for searching a longest prefix match, comprising the steps of: (a) performing a round of binary LPM

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searches by executing a plurality of search instances, each search instance searching in a different range of the initial search area (columns 7 and 8, lines 60-67 and 1-9, respectively); (b) in response to the last round of binary LPM searches, defining a new search area by eliminating from further searches, one or more ranges (once it is established if the prefix should be larger or smaller the search is conducted in the respective direction, as described in columns 7 and 8, lines 60-67 and 1-9, respectively); (c) performing a further round of binary LPM searches by executing the plurality of search instances, each search instance searching in a different sub-range of the new search area (Figure 11, tree structure is an example of such a search); (d) in response to the last round of binary LPM searches, defining further a new search area by eliminating, from further searches, one or more sub-ranges (wherein the sub-range is considered to be part of previous range); (e) storing a longest match if found in a round of binary LPM searches (column 17, lines 20-24), and (f) if necessary, repeating steps (c) to (e) to further narrow the new search area until either one of the search instances finds a longest matching prefix or all the search areas have been searched, in which case the last longest match becomes the longest matching prefix (as shown in figure 18, if the LMP is not found then the searching algorithm is repeated). Turner does not teach however, that a plurality of search instances is performed in parallel. Lin teaches a binary search engine method wherein binary searches are executed in parallel (column 1, lines 12-15). It would have been obvious to one of ordinary skill in the art during the time the invention was made, to make a use of Lin's teaching about performing binary search in parallel and adapt it in Turner's search algorithm because

this would increase device speed and decrease data packet latency (column 1, lines 55-64).

Note: Claim 19 comprises all the elements of the apparatus, which are essential in order to execute the method disclosed in claims 1 and 13. Similarly, since Turner's and Lin's combined teachings teach all the limitations disclosed in claims 1 and 13, they also inherently teach all the elements disclosed in claim 19.

As to claim 2, Turner teaches the method wherein the database is routing table in a packet forwarding device and the plurality of prefixes are logically sorted in groups in an ascending order of their lengths (column 21, lines 43-48).

As to claims 3, 15 and 24, Turner teaches the method wherein step (a) is performed with search instances starting at predetermined locations within their respective ranges (wherein each branch can be interpreted as a respective range), the predetermined locations being about the midpoint (the search starts at the closest midpoint and if value is smaller than the search shifts to the left, again starting at the middle, column 7, lines 60-67, column 8, lines 1-9) in the lowest range and being progressively shifted toward the respective low ends within higher ranges (this will be performed if the prefix will be bigger than middle value, column 7, lines 60-67 and column 8, lines 1-9).

As to claim 4, Turner teaches the method wherein the step of defining the new search area comprises a step of: eliminating those ranges or sub-ranges which contain prefixes shorter than the longest match of the last round of the binary LPM searches

(column 8, lines 1-9, if the prefix length is greater than binary search algorithm proceeds further eliminating the shorter lengths).

As to claims 5 and 14, Turner teaches the method wherein the step of performing a further round of binary LPM searched comprises the step of: in response to the last round of binary LPM searches, determining locations within the new search area at which the search instances start the next round of binary LPM searches, directing the search instances which searched the eliminated ranges or sub-ranges in the last round to begin the further round of binary LPM searches at the determined locations/bins of the new search area which contains the last longest match (in the binary search decisions about matching entries are made, and from there new ranges to search are selected, column 7, lines 60-67 and column 8, lines 1-9).

As to claim 6, Turner teaches the method wherein when determining the locations within the new search area, the order of the search instances are maintained (the tree structure has a maintained order so that if the search proceeds it will be conducted in ordered manner, Figure 7).

As to claims 7, 10, 16, 25 and 28, modified teaching of Turner and Lin also teaches the method wherein the step of executing a plurality of search instances in parallel, comprises the step of: issuing parallel memory accesses to several memory banks (Lin, column 2, lines 7-9) at once to access in parallel a plurality of bins (Turner, figure 6) in either the initial or new search area.

As to claims 8, 11, 17, 26 and 29, Lin teaches a method further comprising a step of: issuing several memory accesses to a single memory bank to access in parallel a

plurality of bins in either the initial or new search area such that the latencies of these memory accesses overlap (column 13, lines 46-50, there can be more than one table (main memory bank) and each table can be divided into the series of parallel memory banks (bins), which can be searched simultaneously).

As to claims 9, 12, 18, 27 and 30, Turner and Lin teach all the limitations disclosed in claim 3, however Turner alone does not teach the issuing a plurality of prefetch instructions and accessing in parallel a plurality of locations in either the initial or new search area. Lin teaches using cache to store or prefetch some entries at binary boundary and he also teaches parallel search (column 13, lines 46-50). It would have been obvious to one of the ordinary skill in the art during the time the invention was made to use cache to temporally store important information as taught by Lin in Turner's invention because this would reduce latency or in other words improve performance (column 14, lines 48-63).

As to claim 20, Turner teaches the apparatus wherein the routing table comprises a plurality of bins, each of which contains one or more prefixes of a same length (Figure 6, wherein the bins are the tables with specific lengths, i.e. 1, 2, 3, ...) and may also contain at least one marker (column 7, lines 25-34), the bins being logically sorted in order of their prefix lengths and the initial search area being divided into a plurality of contiguous ranges, each range containing a predetermined number of bins (as shown in figure 6).

As to claim 21, Turner teaches the apparatus wherein each range, bins are preordered for access by the search instances for each round of searches, if no match

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or marker is found (Figure 6, all the bins are preordered based on the prefix length, column 8).

As to claim 22, Turner teaches the apparatus wherein the ranges contain sufficient number of bins to accommodate a desired number of prefixes in compliance with Ipv6 (column 10, lines 30-37).

As to claim 23, Turner teaches the apparatus wherein the size of the ranges are predetermined so that the worst case memory accesses are evened out across all the ranges (column 10, lines 30-37, since the markers can be shared and the worst case is bound on marker storage, therefore the memory access is evened out).

Response to Arguments

5. Applicant's arguments filed August 4, 2006 have been fully considered but they are not persuasive.

6. With respect to the applicant's assertion about no need of presenting the main purpose for the claimed invention multiple number of times in the single application, the examiner agrees with the applicant on this matter, however please note that there is still 35 U.S.C 101 deficiency in claim 1.

7. Further, the applicant argues on page 3, that the Turner does not disclose running multiple searches in parallel, however the examiner would like to note that this deficiency was clearly pointed out in the first office action, and that is why the 35 U.S.C 103(a) has been made not 35 U.S.C 102. The "search instances" cited by the applicant

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are also taught by Turner, in particular "markers" are considered to perform its function (column 10, lines 4-9).

8. With respect to the applicant's argument on page 4, stating the Lin teaches the parallel search, however as alleged by the applicant, those parallel searches do not carry multiple search instances performing the same search. The examiner would like to note that the limitations not disclosed in the claim are not given patentable weight. In particular the phrase "same search" is not present in any of the independent claims, better yet, the applicant disclosed in the independent claims 1, 13 and 19, in the step b that the round of the binary LPM searches is carried out.

9. Same interpretation as stated above, also pertains to the arguments regarding independent claim 19.

The Prior Art

10. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

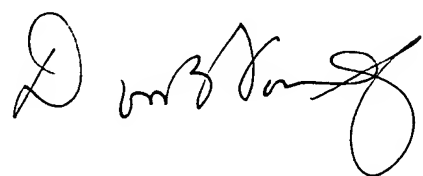
- US Publication 20040044868 discloses a method and apparatus for high-speed longest prefix match of keys in a memory using binary search.
- US Patent 6810037 discloses an apparatus and method for sorted table binary search acceleration.

Inquiry

11. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Angela M. Lie whose telephone number is 571-272-8445. The examiner can normally be reached on M-F.
12. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Don Wong can be reached on 571-272-1834. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.
13. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.



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